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(56) Cited documents:
EP-A-0 254 454 **WO-A-92/00194**

- **PATENT ABSTRACTS OF JAPAN, Vol. 9, No. 412 (M-388)(1865) June, 18 1985 & JP-A-60 023 064 (MATSUSHITA DENKI SANGYO K.K.) February, 5 1985**
- **PATENT ABSTRACTS OF JAPAN, Vol. 14, No. 60 (M-931)(4003) February, 5 1990 & JP-A-01 286 866 (TOKYO ELECTRIC CO LTD) November, 17 1989**

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Description

The invention concerns a thermal printer.

A thermal printer is known from WO 92/00194, in which the sheets being printed are provided with visible markings on the front. The thermal printer is equipped with a sensor that senses the markings. By means of the markings, which represent the amount of energy required to achieve an optimal printing quality, the energy is fed in a controlled manner to the printing head during the printing process. The markings can also transmit, to the printer, the size of the surface being printed.

Since the markings are applied to the side of the sheets being printed, it is considered a drawback that an additional working step after the printing process, namely, separation of the markings from the sheets, proves to be necessary, if one would like to not have the markings be optically noticeable as a drawback on the finished printed sheet.

The task of the present invention is therefore to devise a thermal printer whose control adjusts automatically to the type of label paper inserted into the printer, in which the text printed on the labels is not to be disturbed by markings.

According to the invention, this task is solved by a thermal printer with a thermal printing head having a series of electrically controllable heating elements that are held in contact against a platen roller, in which the labels being printed could be passed between the heating elements and the platen roller, a device for holding a supply reel and a takeup reel for the thermal-transfer ink ribbon, which can be passed over deflecting rollers between the heating elements and the labels, a control circuit connected to the thermal printing head to control the thermal printer, a processor connected to the control circuit, a read/write memory connected to the processor to store information to be printed on the labels, and a data input device connected to the read/write memory and the processor, in which the labels or a support strip holding the labels are provided with at least one marking that is not recognizable by the human eye, with the thermal printer having a scanner connected to the processor to scan the markings.

By means of the markings, the processor recognizes, via the scanner, whether normal paper labels are inserted into the thermal printer, so that it must initiate transport of the thermal-transfer ink ribbon during the printing process, or it recognizes whether labels of temperature-sensitive paper are inserted into the printer, so that the use of a thermal-transfer ink ribbon is unnecessary. In addition, a thermal printing head in the thermal-transfer printing operation is to be controlled with less energy than in thermal direct printing operations. By means of the corresponding markings, the processor can recognize the type of inserted label paper and initiate the control circuit to control the thermal printing head with more or less energy. In addition, the text printed on the label is not disturbed by markings, since these are not recognizable by the

human eye. Finally, with markings, one can avoid the situation in which labels that are not provided for this or that are completely unsuited for it are inserted into the thermal printer.

Markings in any size that do not disturb the typeface situated on the labels can be applied to the side of the labels to be printed with physical text, if the scanner is designed as a sensor that is sensitive to infrared light signals or UV light signals and if the markings are applied to the labels with ink that exclusively reflects infrared light or UV light.

A larger amount of information can be stored on the labels for a variety of purposes, if at least one magnetic strip with magnetically stored markings is arranged on the labels or on the label support strip, and if the scanner is designed as a magnetic strip reading head.

Simple possibilities of applying markings to control the thermal printer, so that the printed image on the labels is not disturbed, are obtained when the markings are applied to the back side of the label support strip accessible to the scanner, or applied to the sides of labels consisting of cardboard, not intended for printing.

If the markings are designed as electrical-tuned circuits arranged between two paper layers that oscillate with stipulated frequencies, when exposed to a frequency-variable electromagnetic field and emission fields with the stipulated frequencies that can be sent by a scanner designed as a magnetic field receiver, in which the frequency levels are the carriers of the information content of the markings, labels are obtained that can also be used to prevent the theft of products offered for sale in food stores.

In particular, in very small labels it is advantageous if the markings have a size in which they are not recognizable by the human eye, and if the markings are applied to the front of the labels or to the back of the label support strip.

Some practical examples of the invention are further explained below with reference to the figures. Here:

Figure 1 is a schematic view of a thermal, thermal [sic] transfer printer,
Figure 2. is a label printed partly with ink visible to the human eye and with ink invisible to it,
Figure 3 is a label marked with a magnetic strip,
Figure 4 is a practical example of a label with a tuned circuit as a marking,
Figure 5 is the electrical schematic of the label depicted in Figure 4, and
Figure 6 is the structure of the label depicted in Figure 4 in cross section.

The thermal printer 1 depicted in Figure 1 has a thermal printing head 2, which is electrically connected to a process 4 via a control circuit 3. Electrically controllable heating elements 5 that are held against a platen roller 6 are arranged on the bottom of thermal printing

head 2. The heating elements 5 are preferably arranged in a straight row lying in a plane perpendicular to that of the drawing. A label strip 7 can be passed between heating elements 5 and platen roller 6, which is unwound from a label strip feed reel 8 during printing and delivered through an outlet opening 9 of the thermal printer 1 after it has been printed with the information prescribed for it.

The label strip 7 can consist of temperature-sensitive paper that is printed, due to the fact that it is moved past the partially heated, spot-like heating elements 5, and as therefore blackened by heating at the sites prescribed for them. The label strip 7, however, can also consist of ordinary writing paper, in which case it is essential to pass thermal-transfer ink ribbon 10 between the label strip 7 and the heating elements 5 of the thermal printing head 2, which is coated with temperature-sensitive ink that melts at the sites that are moved past the heated heating elements 5. The molten ink remains adherent to the label strip 7 and forms the desired printing image. The thermal-transfer ink ribbon 10 is preferably accommodated in a cassette 11 with a feed reel 12 and a takeup reel 13, which is arranged in the thermal printer 1 via devices 14, 15 for holding the reels 12 and 13. In addition, deflecting rollers 16, 17 are provided in the thermal printer 1, which ensure that the thermal transfer ink ribbon 10 is moved past the heating elements 5 at the optimal angle for this.

A data input device 30 is connected to the processor 4 via a control line 18 and a read/write memory 25 via data lines 19. The data input device 30 is equipped with a schematically depicted computer keyboard 31 and a memory card reading device 32.

Finally, the thermal printer 1 has a scanner 20 that is arranged near the label strip 7 and si connected to the processor 4 via a data line 21. The scanner 20 can be designed as a sensor that is sensitive to infrared light signals or UV light signals, if the markings to be scanned by the scanner on label 7 or on its support strip are applied with ink that reflects infrared light or UV light. If it is prescribed to apply the markings to label 7 by means of magnetic strip 29, scanner 20 is to be used as magnetic strip reading head. In this case, the scanner 20 can be arranged either near the front side of the label or near the back side of the support strip, depending on whether the markings are to be applied to the front of the labels being printed or applied to the visible back side of the label support strip. During the use of cardboard labels, it is advantageous to apply the markings on the back side not intended for printing, in whose vicinity the scanner 20 is then also arranged.

During the use of high frequency anti-theft labels, which as explained further below are equipped with a high-frequency tuned circuit, there is a possibility of adjusting the tuned circuit to a stipulated identification frequency that provides information concerning the condition of the label. In this case, a magnetic field receiver is used as scanner 20, which can be designed as a coil connected to a frequency analyzer. If such a label 7 is exposed to a high-frequency

electromagnetic field by a magnetic field transmitter 22 that can consist of a coil 24 connected to an oscillator 23 whose frequency is periodically varied between a maximum value and a minimum value, between which the identification frequency of the tuned circuit must lie, the label begins to oscillate at the frequency identifying it. This frequency is analyzed by the frequency analyzer and the value resulting from this provides information concerning the type of label paper used.

In very small labels, in particular, it is advantageous if the markings applied to the labels have a size in which they are no longer recognizable by the human eye. A laser scanner 20 is required for the scanning of such markings, which has the advantage that the laser beam scanning the markings can be very strongly bundled and therefore can read even the smallest markings, for example, in the form of a bar code.

After startup of thermal printer 1, the information to be printed on labels 7 is initially entered in the read/write memory 25 via the data input device 30, controlled by processor 4. For this purpose, the computer keyboard 31 can be used alone or together with the memory card reading device 32. The scanner 20 then scans the inserted label 7, also controlled by processor 4. The resulting signals-- indicating, for example, that normal paper labels are inserted, for whose printing thermal-transfer ink ribbon 10 is required--are furnished to processor 4. This now retrieves from the read/write memory 25 the information to be printed on labels 7 and sends these, together with control data that indicate that ordinary paper labels are inserted and are to be printed with less energy than thermal labels, to control circuit 3. The control circuit 3 then causes the thermal printing head 2 to start the printing process. The processor 4 also causes, via an electrical line and driver circuits not shown in the figure, both the platen roller 6, driven by electric motor to transport the label strips 7 past the heating element 5 of the thermal printing head 2, as well as the takeup reel 13, driven by an electric motor, to further transport the thermal transfer ink ribbon. The labels 7 printed in this manner are delivered through the outlet opening 9.

A practical example of a label 7' is shown in Figure 2, which has two marking fields 24 and 26. A marking 27, which is invisible to the human eye and can only be scanned by a scanner 20 designed as a sensor that is sensitive to infrared light or UV light, is printed on the marking field 24 with an ink that exclusively reflects infrared light or UV light. The marking field 26 contains the product-specific information 28 provided for the customer and printed in the usual manner by means of the thermal printing head 2 on label 7'. The marking 27 and the product-specific information 28 can in this manner by superposed, whereby a good utilization of the pressure range of the labels 7 is allowed.

An example of a label 7" is shown in Figure 3, on one side of which an ordinary magnetic strip 29 is glued. Such magnetic strips have a storage capacity sufficient to store price

information or other product-specific data on the label, in addition to the data characterizing label 7".

A practical example of an anti-theft label 34 containing an electrical tuned circuit 33, 33' is shown in Figures 4 to 6. According to Figure 6, the label 34 consists of a printable upper layer 35 that is arranged on the first element 33' (Figure 4) of the electrical tuned circuit. An insulation layer 36 is situated between the first and second elements 33, 33' of the electrical tuned circuit. The elements 33 of the tuned circuit are covered by a printable lower layer 37.

As shown in Figures 4 and 5, the tuned circuit consists of a first capacitor 38, whose capacitor plates 38' and 38" are arranged on both sides of the insulation layer 36 opposite each other. The capacitor plate 38" is connected to the beginning of the windings of a coil 40, whose end is connected to a first capacitor plate 41' of a second capacitor 41. On the side of the insulation layer 36 opposite the first capacitor plate 41', the second capacitor plate 41" of the second capacitor 41 is arranged. The capacitor plates 41" and 38' are electrically connected on the side of the insulation layer 36 opposite the coil 40.

This type of tuned circuit has a resonance frequency dependent on the capacitance of capacitors 38 and 41 and on the inductance of coil 40, with which the tuned circuit oscillates, when it is exposed to electromagnetic fields with precisely this frequency. By changing the capacitance or inductance values of capacitors 38, 41 or coil 40, this resonance frequency can be adjusted.

If a label 34 is now exposed to an electromagnetic alternating field, whose frequency is varied in a sawtooth manner periodically between a maximum value and a minimum value, in which it is ensured that the values of all possible resonance frequencies of labels 34 are situated within these maximum and minimum values, its tuned circuit begins to oscillate when the alternating field assumes the value of the resonance frequency of the tuned circuit, then emits a field with this frequency. This field can be recognized and evaluated by a frequency analyzer via a magnetic field sensor, so that the processor 4 connected to the frequency analyzer can influence control of the thermal printer 1 with reference to these data.

A first frequency f_1, for example, can mean that the printable upper layer 35 of label 34 consists of temperature-sensitive paper, whereas a second frequency f_2 can mean that the label paper 35 is temperature-insensitive and can only be printed using a thermal-transfer ink ribbon. By analyzing the frequency of the received signal, the processor 4 can decode the above information and use it to control the thermal printer 1 by activating the drive of the thermal-transfer ink ribbon 10, when it measures frequency f_2.

Claims

1. A thermal printer (1) comprising

   a) a thermal print head (2) with a row of electrically controllable heating elements (5) which are held up against a platen roller (6), labels (7) to be printed being passed between the heating elements (5) and the platen roller (6);
   b) respective means (14, 15) for holding a supply reel (12) and a take-up reel (13) for a thermal transfer ink ribbon (10) which can be passed over deflecting rollers (16, 17) between the heating elements (5) and the labels (7);
   c) a control circuit (3) connected to the thermal print head (2) for controlling the thermal printer (1);
   d) a processor (4) connected to the control circuit (3);
   e) a read/write memory (25), connected to the processor (4) for storage of information to be printed on the labels;
   f) a data input device (30) connected to the read/write memory (25) and to the processor (4), wherein
   g) the labels (7) or a carrier strip holding the labels (7) are or is provided with at least one marking which is not visible to the human eye and
   h) the thermal printer (1) is provided with a scanner (20) connected to the processor (4) to scan the markings.

2. A thermal printer according to claim 1, characterised in that the scanner (20) takes the form of a sensor that is sensitive to infrared light signals and the markings (27) on the labels (7') are applied using ink that reflects exclusively infrared light.

3. A thermal printer according to claim 1, characterised in that the scanner (20) takes the form of a sensor that is sensitive to UV light signals and the markings (27) on the labels (7') are applied using ink that reflects exclusively UV light.

4. A thermal printer according to claim 1, characterised in that at least one magnetic strip (29) having magnetically stored markings is disposed on each of the labels (7') or on the label carrier strip and that the scanner (20) takes the form of a magnetic strip reader head.

5. A thermal printer according to one of claims 1 to 4, characterised in that the markings are applied on the rear side, accessible to the scanner (20), of the label carrier strip.

6. A thermal printer according to claim 1, characterised in that the labels (7) consist of cardboard and that the markings readable by the scanner (20) are applied on the side thereof that is not to be printed.

7. A thermal printer according to claim 2, characterised in that the markings take the form of electrical tuned circuits (33, 33'), each disposed between two layers of paper (35, 37), which oscillate at predetermined frequencies if they are irradiated by a variable-frequency electromagnetic field, and thereby radiate fields with the predetermined frequency which can be detected by a scanner (20) in the form of a magnetic field detector, the frequency levels being the carriers of the information contained in the markings.

8. A thermal printer according to claim 1, characterised in that the markings are of a size such that they are not detectable by the human eye, and that the markings are applied on the front sides of the labels (7) or on the rear side of the label carrier strip.

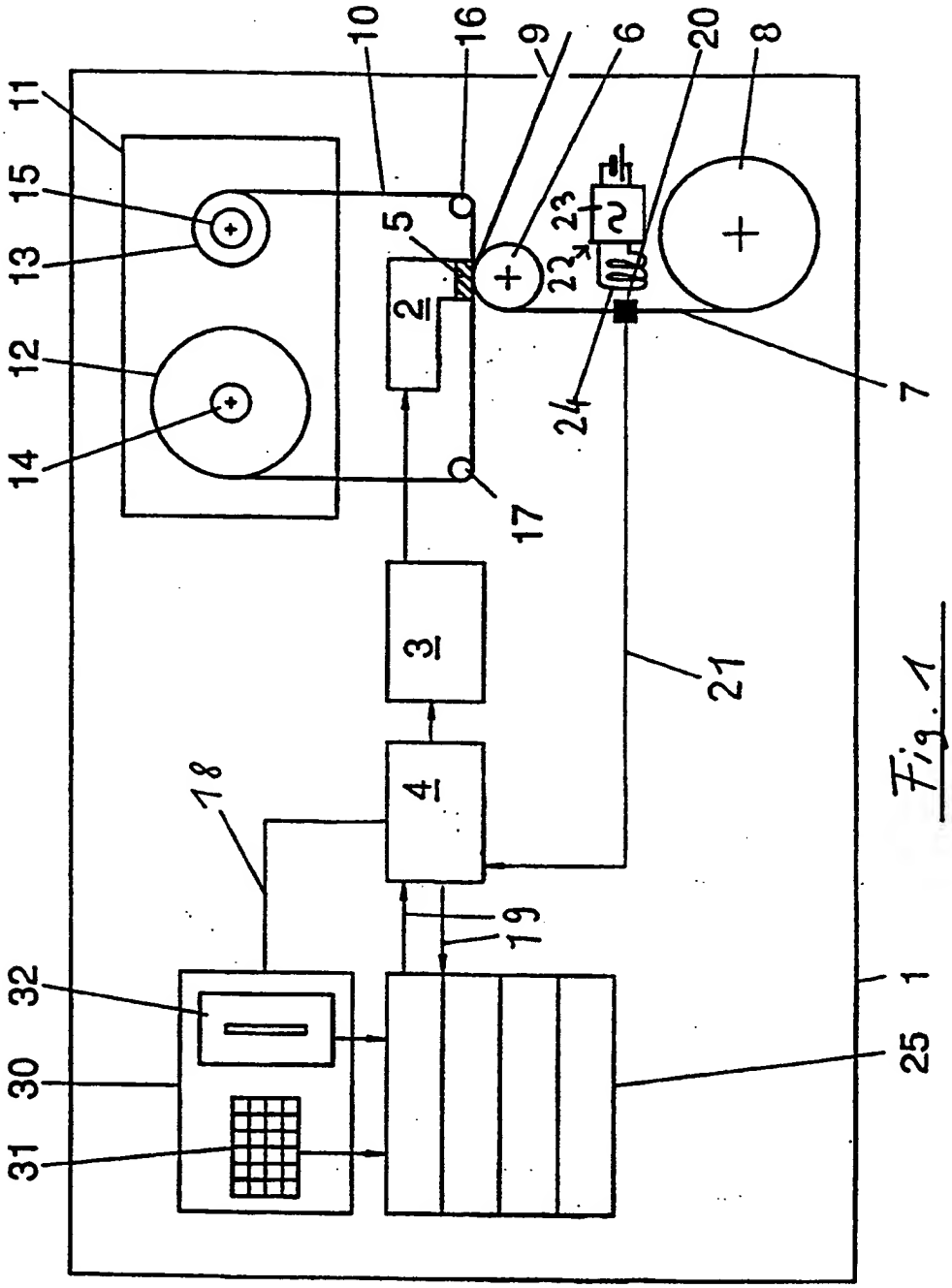

Fig. 1

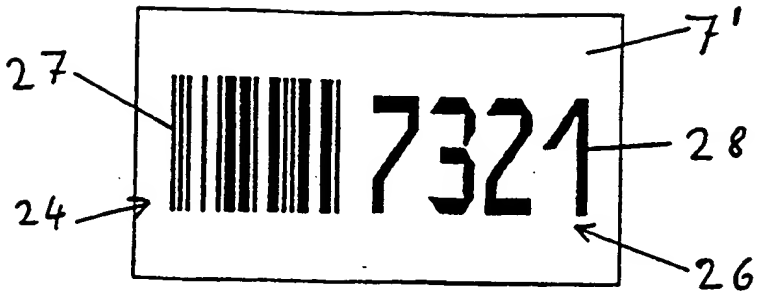

Fig. 2

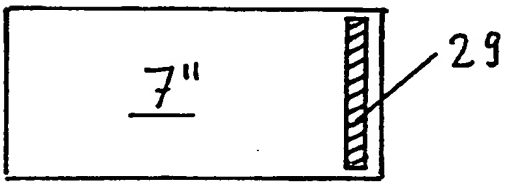

Fig. 3

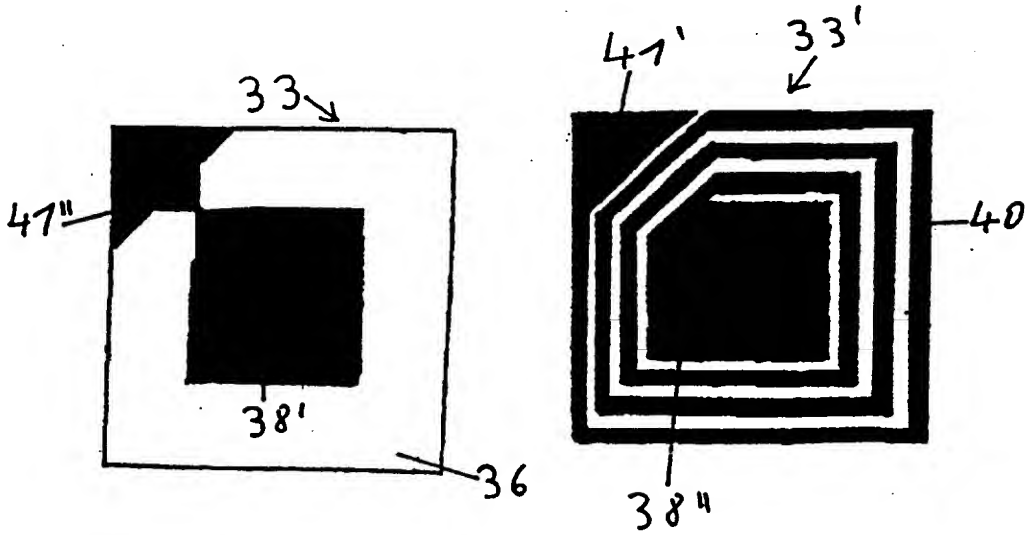

Fig. 4

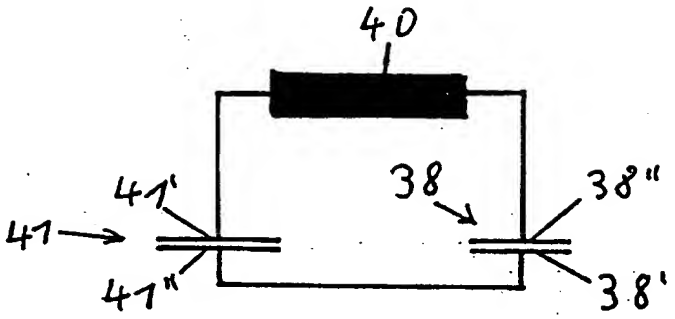

Fig. 5

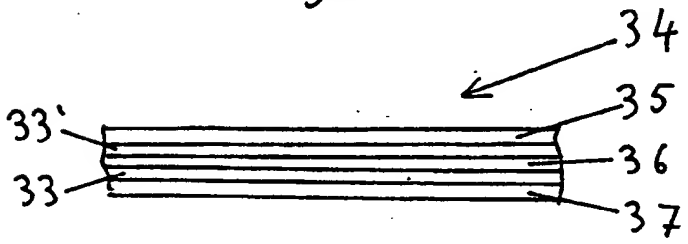

Fig. 6

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Translated from German into English
Code No. 55-4123